
Book Reviews

Reviewed by Janez Grum

Email: janez.grum@fs.uni-lj.si

1 Crystallography and Crystal Defects

by: **A. Kelly and K.M. Knowles**

Published 2012

by **WILEY, John Wiley & Sons, Ltd., The Atrium**

South Gate, Chichester, West Sussex, PO19 1SQ, UK, 521pp

ISBN: 978-0-470-75014-8

ISBN: 978-0-470-750155 (HB)

ISBN: 978-0-470-750148

This fully revised and updated edition has been prepared by a very active worker in the field, who has used previous editions extensively both in teaching and in research, together with one of the original authors. Since the first edition, written in the late 1960s, understanding of crystal defects such as dislocations, stacking faults, twin, grain and interphase boundaries and of their effect on the mechanical and electrical properties of materials has grown enormously and has been accompanied by a total change in style of the way in which both research and teaching are carried out through the use of the fast digital computer. This edition takes account of this change.

This edition has discussions of a number of new topics not covered in previous editions such as piezoelectricity, groups, subgroups and supergroups, liquid crystals, incommensurate materials and the structure of foamed and amorphous materials, and martensitic transformations in nickel-titanium shape memory alloys and zirconia ceramics. The topic of quasicrystalline materials, covered briefly in the revised edition published in 2000, has been rewritten and linked to discussions of icosahedral packing and the understanding of topologically close-packed structures.

Constructions involving the stereographic projection have been moved to an appendix. It is now usual to produce stereographic projections via proprietary software packages.

Tables of data and references in previous editions have been meticulously checked and updated. Numbered references are listed in full at the end of each chapter, together with suggestions for further reading. The problems at the end of each chapter have been reviewed and updated. Brief solutions to these are given after the appendices. Lists of websites and computer software packages relevant to the topics authors have covered here are given in a new appendix.

The book contains the following chapters:

Part I: Perfect crystals

- Lattice geometry
- Point groups and space groups

- Crystal structures
- Amorphous materials and special types of crystal-solid aggregates
- Tensors
- Strain, stress, piezoelectricity and elasticity.

Part II: Imperfect crystals

- Glide and texture
- Dislocations
- Dislocations in crystals
- Point defects
- Twinning
- Martensitic transformations
- Crystal interfaces
- Appendix 1: Crystallographic calculations
- Appendix 2: The stereographic projection
- Appendix 3: Interplanar spacings and interplanar angles
- Appendix 4: Transformation of indices following a change of unit cell
- Appendix 5: Slip systems in C.C.P. and B.C.C. crystals
- Appendix 6: Homogeneous strain
- Appendix 7: Crystal structure data
- Appendix 8: Further resources.

Crystallography and crystal defects, second edition is a valuable resource for senior undergraduate and graduate students of materials science metallurgy, physics, chemistry, electrical, civil and mechanical engineering. It will also prove a useful and comprehensive reference source for advanced researchers.

2 Polymers in Industry from A-Z, A Concise Encyclopedia

by: L. Mascia

Published 2012

by Wiley-VCH Verlag GmbH & Co. KgaA

Boschstrasse 12, 69469 Weinheim, Germany, 350pp

ISBN: 978-3-527-32964-9 (Print)

ISBN: 978-3-527-64405-6 (ePDF)

ISBN: 978-3-527-64403-2 (oBook)

ISBN: 978-3-527-64404-9 (ePub)

ISBN: 978-3-527-64406-3 (Mobi)

Polymers are a well-established class of materials both in the commercial sector and in educational curricula. Polymers are the main component of commercial products known as plastics, composites, rubber (or elastomers), surface coatings, fibres and adhesives.

A compact encyclopaedia provides the easiest and most rapid route for retrieving both specific and general information about the subject of interest. This is particularly valuable when the reader is interested primarily in the basics of the subject.

Although the central focus of this book is on aspects concerned with the constitution, properties and processing of polymer-based materials, the treatment extends into related areas, including synthesis and characterisation. The amount of information and details provided for each entry, therefore, varies according to the anticipated needs and interests of the potential reader within the core areas.

The contents of the text have been derived with the view that the field spans various disciplines and branches of industry and, therefore, the needs of the potential reader beyond the boundaries of these areas are served by complementary texts related to other sectors, such as the petrochemical industry and specific manufacturing concerns.

This desktop and library reference book provides a comprehensive yet concise overview of the materials, manufacture, structure and architecture, properties, processing, and applications in the field of polymers. The book offers a unique mix of theory and application, the essential personal reference for anyone studying or working in the field of polymers.

3 Intelligent Nanomaterials, Processes, Properties, and Applications

by: A. Tiwari, A.K. Mishra, H. Kobayashi and A.P.F. Turner

Published 2012

by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey

111 River Street, Hoboken, NJ 07030-5774, USA, 383pp

ISBN: 978-0-470-93879-9

The creation of new materials is one of the fundamental driving forces of industry and lays the foundation for new products to enhance the wealth and well-being of society. The last three decades has seen extraordinary advances in the generation of new materials based on both fundamental elements and composites, driven by advances in synthetic chemistry and often drawing inspiration from nature. The concept of an intelligent material envisions additional functionality built into to the molecular structure, such that a desirable response occurs under defined conditions. The last decade has seen the emergence of particular material properties engineered by exploiting the extraordinary behaviour of nanostructures.

The book contains the following chapters:

- *Part I: Inorganic materials:*
 - Synthesis, characterisation, and self-assembly of colloidal quantum dots
 - One-dimensional semiconducting metal oxides: synthesis, characterisation and gas sensors application
 - Rare-earth-based insulating nanocrystals: improved luminescent nanophosphors for plasma display panels

- Amorphous porous mixed oxides: a new and highly versatile class of materials
- Zinc oxide nanostructures and their applications
- Smart nanomaterials for space and energy applications
- Thermochromic thin films and nanocomposites for smart glazing.
- *Part II: Organic materials*
 - Polymeric nano-, micellar- and core-shell materials
 - Conjugates of nanomaterials with phthalocyanines
 - Nanostructured carbon and polymer materials – synthesis and their application in energy conversion devices
 - Advancement in cellulose based bio-plastics for biomedical.
- *Part III: Composite materials*
 - Intelligent nanocomposite hydrogels
 - Polymer/layered silicates nanocomposites for barrier technology
 - Polymers/composites based intelligent transducers.
- *Part IV: Biomaterials and devices*
 - Hydrogel nanoparticles in drug delivery
 - Mode of growth mechanism of nanocrystal using biomolecules
 - Quantum dots for detection, identification and tracking of single biomolecules in tissue and cells
 - Nanofibres-based biomedical devices
 - Nano-sized carrier systems as new materials for nuclear medicine
 - Biomimetic materials toward application of nanobiodevices
 - Lipid-based nano-biosensors for medical diagnostics
 - Polymeric nanofibres and their applications in sensors

This book aims to provide an up-to-date introduction to the fascinating field of intelligent nanomaterials. In general description, this large and fairly comprehensive volume includes 22 chapters divided into four main areas: inorganic materials, organic materials, composite materials, and biomaterials. It covers the latest research and developments in intelligent nanomaterials: processing, properties, and applications. Included are molecular device materials, biomimetic materials, hybrid-type functionalised polymers-composite materials, information-and energy-transfer materials, as well as environmentally friendly materials. The book is written for a large readership including university students and researchers from diverse backgrounds such as chemistry, materials science, physics, biological science and engineering. It can be used not only as a textbook for both undergraduate and graduate student, but also as a review and reference book for

researchers in the materials science, bioengineering, pharmacy, biotechnology and nanotechnology.

This book is written for a large readership including university students and researchers from diverse backgrounds such as chemistry, materials science, physics, biological science and engineering. It can be used not only as a textbook for both undergraduate and graduate students, but also as a review and reference book for researchers in the materials science, bioengineering, pharmacy, biotechnology and nanotechnology disciplines.

4 Computational Frameworks for the Fast Fourier Transform

by: C.V. Loan

Published 1992

by SIAM Society for Industrial and Applied Mathematics, 3600

University City Science Center,

Philadelphia, PA 19104-2688, USA, 273pp

ISBN: 978-0-898712-85-8

The fast Fourier transform (FFT) is one of the truly great computational developments of this century. It has changed the face of science and engineering so much so that it is not an exaggeration to say that life as we know it would be very different without the FFT.

Unfortunately, the simplicity and intrinsic beauty of many FFT ideas are buried in research papers that are rampant with vectors of subscripts, multiple summations, and poorly specified recursions. The poor mathematical and algorithmic notation has retarded progress and has led to a literature of duplicated results. The central theme in this book is the idea that different FFT algorithms correspond to different factorisations of the discrete Fourier transform (DFT) matrix. The matrix factorisation point of view, so successful in other areas of numerical linear algebra, goes a long way toward unifying and simplifying the FFT literature. It closes the gap between the computer implementation of an FFT and the underlying mathematics because it forces us to think well above the scalar level.

The book contains the following chapters:

- *The Radix-2 frameworks*: Matrix notation and algorithms, the FFT idea, the Cooley–Tukey Radix-2 factorisation, weight and butterfly computations, bit reversal and transposition, the Cooley–Tukey framework, the Stockham autosort frameworks, the Pease framework, decimation in frequency and inverse FFTs.
- *General Radix frameworks*: General Radix ideas, index reversal and transposition, mixed-Radix factorisations, Radix-4 and Radix-8 frameworks, the Split-Radix framework.
- *High-performance frameworks*: The multiple DFT problems, matrix transposition, the large single-vector FFT problem, the multidimensional FFT problem, distributed-memory FFTs, shared-memory FFTs.
- *Selected topics*: Prime factor frameworks, convolution, FFTs of real data, fast trigonometric transforms, fast Poisson solvers.

This volume is essential for professionals interested in linear algebra as well as those working with numerical methods. The FFT is also a great vehicle for teaching key aspects of scientific computing.

5 The Fracture of Brittle Materials

**by: S.W. Freiman and J.J. Mecholsky, Jr., S.N. Mathaudhu,
W.H. Sillekens, N.R. Neelameggham, N. Hort**

Published 2012

by The American Ceramic Society,

John Wiley & Sons, Inc., Hoboken, New Jersey

ISBN: 978-0-470-15586-8

The purpose of this book is to bring together the background, testing procedures, and analysis methods needed to design and use materials that fail in a brittle manner. In this context, we define ceramics quite broadly as any inorganic non-metal. Such a definition includes diverse materials, such as semiconductors, other single crystals, cement and concrete, and of course the oxides, carbides, nitrides, and so on that, we normally think of as ceramics. Ceramics are also used in composite form, either by dispersing one phase in another or by crystallising phases from a glassy matrix. Most test procedures designed for monolithic bodies can be used here as well. However, continuous fibre-reinforced composites behave quite differently, and will not be discussed herein. Ceramics are also increasingly used in films and coatings, but determining the mechanical properties of materials in these forms is more complex, and will not be addressed in this book.

This book addresses testing and analysis at temperatures at which the material behaves in a brittle manner. At elevated temperatures, other modes of failure often are important. These include creep, as well as general plastic deformation. Both of these topics are outside the scope of this book.

In this book, we provide the reader with some of the background needed to understand the brittle fracture process, as well as a basis for choosing the proper test procedures. The mathematical development of the expressions used to calculate the various properties will be kept to a minimum; the reader will be referred to fundamental references. The authors intend to provide sufficient examples to allow the reader unfamiliar with the tests to be able to perform the test procedures properly. Questions to test comprehension for self-evaluation will be given at the conclusion of each chapter.

The book contains the following chapters:

- Introduction
- Fracture mechanics background
- Environmentally enhanced crack growth
- Fracture mechanics tests
- Strength testing
- Quantitative fractography

- Microstructural effects
- Predicting reliability
- Concluding remarks.

Throughout the book, figures and illustrations help readers understand key concepts and methods. Replete with real-world examples, this text enables engineers and materials and ceramics scientists to select and implement the optimal testing methods for their particular research needs and then accurately analyse the results.

6 Fatigue and Durability of Structural Materials

by: S.S. Manson and G.R. Halford

Published 2006

by ASM International, Materials Park, Ohio 44073-0002, USA, 456pp

ISBN-13: 978-0-87170-825-0

ISBN-10: 0-87170-825-6

The past half century has witnessed a virtual revolution in the development of two fields which are the subject of this book: the introduction of advanced materials as structural components in several loaded machines exposed to high temperatures and temperature gradients, and the development of technology of life computation of such components, of which one of the major failure mechanisms is fatigue. This book is based on the experience of the authors during this period.

The book presents the following issues: introduction, stresses and strain cycling, fatigue life relations, mean stress, multiaxial fatigue, cumulative fatigue damage, bending of shafts, notch effects, crack mechanics, mechanism of fatigue, avoidance, control, and repair of fatigue damage, special materials: polymers, bone, ceramics.

Although it emphasises our research both as individual and as colleagues for half a century, it also includes the work of numerous others who have provided useful results that have moved progress in these fields.

7 Astronautics: The Physics of Space Flight, 2nd, Enlarged and Improved Edition

by: U. Walter

Published 2012

by Wiley-VCH Verlag GmbH & Co. KGaA

Boschstrasse 12, 69469 Weinheim, Germany, 568pp

ISBN: 978-3-527-41065-1 (Hardcover) (Print)

ISBN: 978-3-527-41035-4 (Softcover)

As a crewmember of the D-2 shuttle mission and a full professor of astronautics at the Technical University in Munich, Ulrich Walter is an acknowledged expert in the field. He is also the author of a number of popular science books on space flight.

The second edition of this textbook is based on extensive teaching and his work with students, backed by numerous examples drawn from his own experience. With its end-of-chapter examples and problems, this work is suitable for graduate level or even

undergraduate courses in space flight, as well as for professionals working in the space industry.

The book contains the following chapters: rocket fundamentals, rocket flight, rocket staging, thermal propulsion, electric propulsion, ascent flight, orbits, orbital manoeuvring, interplanetary flight, re-entry, three-body problem, orbit perturbations, reference frames, orbit determination, rigid body dynamics.